

The Herschel-Heterodyne Instrument for the Far-Infrared (HIFI)

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The Heterodyne Instrument for the Far-Infrared is a single-pixel, high-resolution ($>300,000$), spectrometer for ESA's Herschel Space Observatory. The instrument comprises 5 frequency bands covering 480–150 GHz with SIS mixers and a sixth dual band for the 1410–1910 GHz range with Hot Electron Bolometer Mixers. The LO subsystem consists of a X-band synthesizer followed by 14 chains of frequency multipliers, 2 for each frequency band. A pair of Auto-Correlators and a pair of Acousto-optic spectrometers provide instantaneous frequency coverage of 4 GHz with a set of resolutions (140 kHz to 1 MHz) better than < 0.1 km/s. Each frequency band has two mixers operating at orthogonal polarizations. All mixers are designed to have noise performance close to the quantum noise limit. One frequency band is operated at a time. Because of its high spectral resolution and wide frequency coverage, HIFI is expected to make a deep impact on a wide variety of astrophysical investigations, ranging from comets, planetary-satellite atmospheres, star formation, and AGB stars to galactic nuclei. The main science drivers are emission and absorption lines of Water, N[II] and C[II] emission in the ISM, and a molecular inventory of regions as shocked molecular clouds, dense Photon-Dominated Regions (PDRs), diffuse atomic clouds, Hot Cores and proto-planetary disks around newly formed stars, winds from dying stars and toroids interacting with AGN engines.